

REMARKS

Claims 1-49 are pending.

Claims 17-24 and 41-48 are withdrawn.

Claims 1-16, 25-40 and 49 are rejected.

Claims 1, 7-8, 11, 25, 39, and 49 are amended.

New claims 50-51 are added.

Claims 1-16, 25-40, and 50-51 remain in the case for consideration.

Applicant requests reconsideration and allowance of the claims in light of the above amendments and the following remarks.

Claim Rejections – 35 U.S.C. § 103

Claims 1-16, 25-40 and 49 stand rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 5,372,967 Sundaram et al., (“Sundaram”) in view of U.S. Patent No. 6,236,538 Yamada et al., (“Yamada”).

The rejections are respectfully traversed.

Claim 1 is amended to recite,

“forming a semicircular columnar groove in an insulating layer on a semiconductor substrate;

forming underlying conductive lines with a predetermined distance therebetween on said groove;

forming a cylindrical insulating layer in said groove formed with said underlying conductive lines and on the surface of said substrate, wherein *an upper portion of said cylindrical insulator protrudes from an upper surface of said groove*; and

forming upper conductive lines on said insulator to contact with said underlying conductive lines, wherein *said upper conductive lines extend up and around said upper portion of said cylindrical insulator to form a rounded upper conductive line.*” (Emphasis added)

Thus, the cylindrical insulator of the claimed invention is formed in a manner that an upper portion of the insulator protrudes from an upper surface of the groove. In the claimed invention, the protruding portion of the cylindrical insulator allows for the upper conductive lines to wrap up and around the insulator to form a *rounded upper conductive line*, as recited in amended claim 1. The rounded upper conductive line reduces abrupt changes in the magnetic field that would otherwise be caused by sharp turns in the coil. See, for example, FIG.12A and the accompanying text and page 11, lines 32-33 of the present application.

None of the cited references teach or suggest the above limitation of a cylindrical insulator that protrudes from an upper surface of the groove and the rounded upper conductive line.

Instead, as taught in column 3, lines 25-27 of Sundaram, the insulator 19 is deposited in the trench and then it is planarized “so that it is flush with the upper surface” of the surrounding layer. Thus, Sundaram teaches away from protruding a cylindrical insulating core from an upper surface of the groove.

In addition, neither of the cited references teaches wrapping the upper conducting lines up and around a protruding cylindrical insulator to form a rounded upper conductive line. Because Sundaram teaches planarizing the insulator, the upper conducting lines in Sundaram lie flat across the top of the insulator as is shown in FIG. 5.

Furthermore, it is stated in Sundaram that inductor structure 10 shown in FIG. 5 is substantially planar so that additional inductor structures can easily be stacked on top of each other and interconnected using conventional multiplayer metal processing. See col. 3, lines 62-69 of Sundaram. If the insulator of the claimed invention has the shape of the planarized dielectric 19 disclosed in FIG. 5 of Sundaram, it would not be possible to form upper conductive lines extend up and around said upper portion of said cylindrical insulator to form a rounded upper conductive line, as recited in the claimed invention recited in claim 1, because of the *planarized* dielectric 19 underlying the upper conductive lines.

Also, Yamada teaches in FIGS. 36 and 37 that the upper conductive lines are formed flat across the top of the trench.

Consequently, because both Sundaram and Yamada teach flat upper conductive lines, both references fail to avoid the problem of abrupt changes in the magnetic field due to the sharp corners created by these flat upper conductive lines.

Thus, the cited references, either alone or in combination, do not teach or suggest all of the limitations of amended independent claims 1. Thus, the rejection does not present a *prima facie* case of obviousness. Thus, claim 1 is allowable. Also, for these reasons discussed above, independent claims 25 and 49, which recite similar limitations, are allowable.

Further, claims 2-16 depend from claim 1, and claims 26-40 depend from claim 25, and for at least the reasons given for claims 1 and 25 and for their own merits, these claims are also believed to be allowable and the applicants respectfully request their allowance.

With respect to new claim 50, none of the cited references teach or suggest,

“filling the groove with an oxidizable material layer overlying the lower conductive lines,

growing the oxidizable material layer by oxidation to form a cylindrical insulating layer in the groove such that an upper portion of the cylindrical insulator protrudes from an upper surface of the groove;

forming upper conductive lines on the insulator to contact with the underlying lower conductive lines.”

On the contrary, Sundaram teaches away from the claimed invention recited in new claim 50. In particular, as described above, in Sundaram, a core material or a dielectric 19 is planarized after deposition so that it is flush with the upper surface of layer 11. Further, in Sundaram, inductor structure 10 is substantially planar so that additional inductor structures can easily be stacked on top of each other. If the inductor structures 10 of Sundaram has the dielectric 19 formed by the above process of the claimed invention recited in claim 50, it would be very difficult to stack additional inductor structures on the inductor structures 10. See col. 3, lines 62-69 of Sundaram.

Thus, Sundaram does not teach or suggest, “growing the oxidizable material layer by oxidation to form a cylindrical insulating layer in the groove such that an upper portion of the cylindrical insulator protrudes from an upper surface of the groove,” as recited in new claim 50. Thus, applicants respectfully request allowance of new claim 50. For the reasons discussed above, new claim 51 is also allowable.

For the foregoing reasons, reconsideration and allowance of claims 1-16, 25-40, and 50-51 of the application as amended is solicited. The Examiner is encouraged to telephone the undersigned at (503) 222-3613 if it appears that an interview would be helpful in advancing the case.

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Respectfully submitted,

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